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Gyrokinetic study of ASDEX-Upgrade inter-ELM profile evolution

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The gyrokinetic Gene code is used to study Inter-ELM H-mode pedestal profile evolution for an ASDEX-Upgrade discharge. Four main instabilities are observed during various inter-ELM phases—density gradient driven drift waves (DW), microtearing modes (MTM), kinetic ballooning modes (KBM), and electron temperature gradient (ETG) modes. DWs are the dominant pedestal instability during the early density-buildup phase. The drift waves are characterized by significant outward particle flux, and show no evidence of a large pinch mechanism. The electron temperature gradient achieves a critical value early in the ELM cycle, concurrent with the appearance of both MTMs and ETG modes. The nominal profiles are stable to KBMs, but moderate increases in β are sufficient to surpass the KBM threshold. Certain aspects of the dynamics support the premise of KBM-constrained pedestal evolution; the density and temperature profiles separately undergo large changes, but in a manner which keeps the pressure profile constant and near the KBM limit. Non-linear simulations of DW turbulence and ETG turbulence are also described.

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